GETTING READY FOR BABY

Safer Products for Babies and Toddlers: Resources and Recommendations for Retailers

Introduction and purpose

The *Getting Ready for Baby* campaign is providing this document for retailers interested in making and selling safer products for babies and toddlers. It includes resources for avoiding toxic chemicals in certain products and recommendations for comprehensive chemical policies that protect the health of babies and toddlers.

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Section 1: Health Risks from Early Life Exposures to Toxic Chemicals

Children are exposed to an array of toxic chemicals from everyday consumer products, including antimicrobials such as triclosan, bisphenol A (BPA), flame retardants, heavy metals such as lead and cadmium, per- and polyfluoroalkyls (PFASs), phthalates, and solvents. These chemicals are variously linked to increased risk of cancer, diabetes, obesity and other chronic health conditions, as well as adverse effects on development, reproduction, learning and behavior.

Because exposure to these chemicals is widespread, the Centers for Disease Control has detected triclosan in 75% of people tested and BPA, PFASs and ortho-phthalates in the urine or blood of nearly everyone tested.[1] Levels of chemicals in children are often higher than in adults. For example, urinary levels of arsenic,[2] chlorinated phenols,[3] certain phthalates[4] flame retardants and serum levels of triclosan, parabens and the sunscreen chemical benzophenone-3[5] are higher in children than adults.

Young children ingest, absorb and inhale more chemicals because of their behavior – they crawl and play on the ground (where contaminated dust accumulates) and put their fingers and other things in their mouths. They are also more vulnerable to harm from toxic chemicals, because their bodies absorb more chemicals than adults, their immune systems are not fully developed and brains, organs and other bodily systems are still developing.

A. Chemical Exposures are Cumulative

Because a wide variety of harmful chemicals are ubiquitous in children's homes, food, drinking water, consumer products, communities and the broader environment, children are exposed to chemicals from multiple sources so exposure is often cumulative. Combinations of different chemicals or chemicals at high concentrations can also have synergistic effects, which means that the effect of multiple chemicals is greater than the impact expected if the cumulative risks were simply added together.[6] Because the effects of chemical mixtures have not been well-studied, children are being exposed to unknown risks from many chemicals on a daily basis.

> *Eliminating the use of toxic chemicals in consumer products is both practical and critical. Retailers can play a key role in driving these chemicals out of infant and children's products and ensuring substitutes are safe to protect the health of young children.*

Table 1 summarizes a few of the chemicals and the various sources to which children are routinely exposed that could affect their health.

TABLE 1: Everyday Sources of Chemicals and Health Effects

Chemical	Found in	Health effects
Anti-microbials e.g. triclosan (TCS), triclocarban (TCC), nanosilver	Personal care products, soaps, hand sanitizers; clothing; textiles; kitchen tools; baby products; toys; craft supplies; building materials.	TCS, TCC - hormone disruption, antibiotic resistance; TCS - allergies, skin irritation, fetal malformations; Nanosilver – persistent, toxicity in animals.
Bisphenols e.g. BPA, BPS	BPA & BPS - polycarbonate plastic, food can linings, thermal receipt paper; BPA - dental sealants.	BPA & BPS - hormone disruption; BPA -effects on reproduction & development; cancer; genetic damage; obesity and diabetes.
Flame retardants	Foam products, such as furniture, baby gear; electronics; textiles; toys; building materials.	Hormone disruption; effects on development and brain; liver and thyroid toxicity; possibly obesity.
Heavy metals – antimony, arsenic, cadmium	Children's and other household products, including inexpensive jewelry; arsenic- soil, drinking water.	Effects on brain, development, learning and behavior; arsenic – cancer; antimony – possible cancer.
Heavy metal - lead	Paint in homes built before 1978; PVC products including purses, raincoats, shower curtains, pet toys, older children's toys; contaminated soil.	Effects on brain, development, learning and behavior.
Heavy metal - mercury	Fish and seafood; mercury thermometers; compact fluorescent light bulbs; some personal care products; dental amalgams.	Effects on brain, development, learning and behavior.
PFASs	Stain-resistant and waterproof textiles; carpet and textile cleaning products; non-stick cookware; grease-resistant food packaging coatings e.g. pizza boxes, fast food wrappers, microwave popcorn bags.	Effects on reproduction and development; thyroid disease; possibly obesity; hormone disruption; possible kidney, testicular cancer; reduced immune response to vaccines in children.
Phthalates	PVC plastic, including shower curtains, flexible tubing, IV bags, purses, older toys, pet toys, food packaging, backpacks, raincoats and clothing embellishments; nail polish; fragranced personal care and cleaning products.	Hormone disruption; liver and thyroid toxicity; effects on reproduction and behavior; asthma symptoms; obesity.
Solvents	Paint strippers; dry cleaning chemicals; paint thinners/strippers; nail polish removers; spot removers; art materials; adhesives; glues; personal care products & cleaners; contaminated drinking water; children's products.	Effects brain/nervous system & reproduction; liver and kidney toxicity; respiratory impairment; cancer; dermatitis.
Vinyl chloride as a component of PVC plastic	Pipes and building materials; wall, window and floor coverings; wire coatings; vehicle upholstery; furniture fabrics; shower curtains and other household goods; baby products; toys; backpacks; clothing; pet products.	Production releases toxic pollutants linked to cancer, birth defects, learning and developmental problems. Toxic additives in products (heavy metals, phthalates) associated with reproductive and developmental problems.

B. Hormone Disrupting and Neurotoxic Chemicals Put Children's Health in Jeopardy

Hundreds of chemicals are recognized as hormone (or endocrine) disruptors that impact the delicate hormone balance in the human body. Hormone disruptors are especially harmful because they adversely affect human health at very low doses and in utero and early life exposures can have lifelong impacts. There is scientific consensus that hormone disrupting chemicals are linked to adverse effects on male and female reproduction, brain development, thyroid, prostate, metabolism, the cardiovascular system, as well as increased risk for cancer, diabetes and obesity.[7] [8] Examples of chemicals in products that disrupt hormones are BPA, BPS, phthalates, brominated and chlorinated flame retardants, triclosan and PFASs. A 2012 study found fifty-five hormone-disrupting and asthma-inducing chemicals in common consumer products, including parabens, phthalates, BPA, triclosan, ethanolamines, alkylphenols, fragrances, glycol ethers, cyclosiloxanes and ultraviolet UV filters.[9] In addition chemicals in consumer products, everyday exposures to pesticides contribute to children's cumulative exposure to endocrine disruptors. Sources of children's exposure to pesticides include: residues on conventionally grown produce; contaminated soil; household, pet and lawn and garden products; and insect repellents.

A number of chemicals known to disrupt hormones are also *obesogens*, or promoters of fat accumulation.[10] [11] A 2011 National Institute of Environmental Health Sciences (NIEHS) national workshop on the role of environmental chemicals in diabetes and obesity concluded that the scientific literature supports a link between certain environmental chemicals and increased risk for obesity as well as Type 2 diabetes.[12]

The developing brain is very sensitive to the effects of chemical exposures. The CDC estimates that 15% of children or one in six, aged 3-17 have one or more developmental disabilities and growing numbers of children are affected by ADHD and autism spectrum disorders.[13] Two hundred fourteen chemicals are known to adversely affect the brain, including common consumer product chemicals like lead, arsenic, toluene, manganese, tetrachloroethylene and brominated and chlorinated flame retardants.[14] A vast body of science documents the devastating effects of lead exposure on the developing brain, including reduced IQ, learning and developmental problems and adverse effects on behavior. Cadmium is also a potent neurotoxin. One study examined both lead and cadmium exposure, finding that a doubling of prenatal lead exposure was associated with a 3.5 times higher risk for hyperactivity and a doubling of cord blood cadmium was associated with a 1.5 times higher risk for emotional problems.[15]

Targeting Environmental Neuro-Developmental Risks (TENDR), a recent scientific consensus statement by 47 leading scientists and health experts, affirms the harm to the human brain from common chemicals such as flame retardant chemicals, lead, mercury, phthalates, PCBs, air pollution and certain pesticides.[16] The TENDR statement notes that even low levels of exposure to these chemicals during fetal development and early childhood can result in lasting problems with learning, attention and behavior. The statement noted that particular attention is needed to emerging concerns with the effects of phthalates on brain development.

C. Chemicals in Children's Consumer Products

Everyday products in the home are a common source of exposure to toxic chemicals. Chemicals in these products can be released into indoor air, migrate into house dust, provide direct skin contact or be ingested, as with young children who put things in their mouths. Baby and children's products may contain an array of potentially harmful chemicals. Flame retardants are frequently added to baby products with polyurethane foam, including changing table pads, crib mattresses, nap-mats, furniture, car seats and others. Children's clothing and footwear frequently contain flame retardants, formaldehyde, phthalates, and heavy metals. Baby furniture made of composite wood product may off-gas formaldehyde, a respiratory irritant and carcinogen. Toys, accessories, and teething products may contain bisphenols, organotins and other chemicals of concern.

Infant personal care products may contain an array of harmful chemicals, including fragrance, 1,4-dioxane, phthalates, formaldehyde releasers, parabens, triclosan and other chemicals of concern. Food and food processing and packaging are important sources of chemical exposure, such as higher levels of arsenic in infant rice cereals and chemicals in food packaging, including plastics and food container coatings. Most food cans are lined with an epoxy resin that contains BPA. In addition, grease resistant coatings on food packaging provide exposure to perfluoroalkyl substances (PFAS). Hormone-disrupting chemicals, such as phthalates, are known to leach from plastic food processing tubes and equipment, and from plastic containers or can linings into foods and beverages. Types of plastics shown to leach toxic chemicals are polycarbonate, PVC and polystyrene.

See Section 2 for more information on chemicals of concern in baby and toddler products.

D. Health Risks from Exposure to Chemicals of Concern

1. Anti-Microbial Chemicals

Numerous chemicals are added to consumer products for their anti-microbial properties. These products include personal care products, as noted, as well as clothing, textiles, kitchen items, towels, toys, mattresses and baby care products. Because anti-microbials are ubiquitous in textiles and other consumer products used in the home, they are commonly found in house dust. One study found a strong correlation between the presence of antimicrobials in house dust and detection of antibiotic resistance genes.[17] Consumers, scientists and federal agencies are starting to question the safety and efficacy of these chemicals. The FDA is now banning the use of nineteen anti-microbial chemicals in cleansing products for personal use, because manufacturers have failed to demonstrate the efficacy of these chemicals in the face of a growing body of information showing health risks.[18]

Triclosan, a widely used anti-microbial chemical is persistent in the environment and is found in human urine, blood and breast milk. CDC bio-monitoring has detected triclosan in the urine 75% of people tested.[19] One study found an increased risk of fetal malformations was associated with higher levels of triclosan in maternal and fetal cord blood.[20] Another study found an association between low birth weight and decreased gestational age with fetal exposure to triclocarban.[21] Exposure to triclosan is associated with contact dermatitis,[22] responsiveness to airway allergens,[23] food sensitization and adverse effects on muscle health.[24] Triclosan is also a hormone disruptor and there is evidence of endocrine disrupting properties of triclocarban as well.[25] GreenScreen® hazard assessments of triclosan and triclocarban yield scores of Benchmark 1 (avoid - chemical of high concern) and Benchmark 2 (search for safer alternatives) respectively. Both chemicals are ecotoxic and persistent in the environment, but triclosan is also acutely and systemically toxic.[26] A consensus statement by 200 leading scientists and health professionals documents the hazards of triclosan and triclocarban and lack of demonstrated benefit.[27]

Nanosilver is also widely used as an anti-microbial in consumer products with potential to be released into the water, air and soil. One study detected its presence in clothing, toothpaste, a medical mask, shampoo, detergent, a towel, a teddy bear and two humidifiers, as well as its release into wash water.[28] More study of human health effects is needed to fill data gaps on nanosilver, but a GreenScreen® for Safer Chemicals evaluation of hazards associated with nanosilver yielded a score of Benchmark 1 (avoid - chemical of high concern), for conventional silver as well as for one form of nanosilver, due to its very high persistence and evidence of high ecotoxicity and systemic toxicity from repeat doses.[29]

2. Bisphenols, notably bisphenol A (BPA), bisphenol S (BPS)

BPA is a chemical component of polycarbonate plastic in many food and drink containers and in epoxy resin coatings in food cans. Some children's toys are also made of polycarbonate plastic, containing BPA. The Centers for Disease Control (CDC) bio-monitoring program has detected BPA in the urine of 93 percent of adults sampled.[30] Scientists have measured BPA in the blood of pregnant women, in umbilical cord blood and in the placenta, all at levels shown to cause harm in laboratory animals.[31] [32] BPA disrupts hormones in the human body and low-dose early life exposure in rodent and human cellular studies is linked with reproductive and developmental problems, genetic damage[33] and cancer.[34] [35] [36] Higher BPA levels in urine were associated with ovarian dysfunction,[37] recurrent miscarriages,[38] cardiovascular diagnoses, diabetes, obesity, abnormal concentrations of liver enzymes[39] and reported heart disease in humans.[40]

There is growing evidence from both animal and human studies that BPA may be contributing to obesity. Perinatal exposure to BPA followed by a normal diet resulted in increased body weight, elevated insulin and impaired glucose tolerance in adult rat offspring.[41] Children and adolescents with higher urinary BPA concentrations were more likely to be obese.[42]

BPS has replaced BPA in many consumer product applications, such as thermal receipt paper, polycarbonate plastic and other polymer applications. While the safety of BPS has been less studied, there is evidence that it is a hormone disruptor.[43] In addition to BPA and BPS, other bisphenols have shown evidence of hormone disruption, including BPAF, BPB and BPF.[44] A recent study found that exposure to BPA, BPS and phthalates, was associated with increases in oxidant stress, insulin resistance, albuminuria (a marker for kidney disease) and disturbances in vascular function in children.[45] Bisphenols in thermal receipt paper can be an important source of exposure for pregnant shoppers and cashiers in baby retail stores, who handle receipts, as these chemicals are easily absorbed through the skin.

3. Chemicals of Concern in Personal Care Products

Personal care products designed for babies and young children include shampoo, lotion, bubble bath, sunscreen, diaper cream, soap/body wash and baby wipes. Some of these products contain chemicals of concern to children, such as phthalates, parabens, talc, fragrance, formaldehyde-releasing preservatives, triclosan, triclocarban, talc, and ethoxylated chemicals, such as sodium laureth sulfate, polyethylene glycol, PEG-laurate, ceteth-5, steareth-21, octoxynol-9, PEG-8 stearate and others, which can release carcinogenic 1,4-dioxane. Chemicals of concern in sunscreen include hormone disruptors benzophenone, oxybenzone and retinyl palmitate, a form of vitamin A that may harm skin. The state of Minnesota bans triclosan in personal care products for individual use and formaldehyde donors in products designed for children under age 8 at concentrations exceeding 500 parts per million.

Phthalates, added to some products as fragrance binders, are hormone disruptors and associated with increased risk for cancer and developmental and reproductive problems. Parabens are often used as preservatives and are also hormone disruptors, associated with increased risk for cancer and developmental and reproductive problems. 1,4-dioxane is a contaminant in a broad range of personal care products, including many that produce suds. It's a breakdown product of ethyxolated chemicals such as ethylene oxide or PEG compounds. 1,4-dioxane readily penetrates the skin and is considered a likely human carcinogen by the EPA.[46] Triclosan is a common antimicrobial in personal care products, which is a hormone disruptor affecting the thyroid and is toxic in aquatic environments.[47]

Scores of chemicals that release formaldehyde are known as formaldehyde donors, including DMDM hydantoin and quaternium-15, which are respiratory irritants and skin sensitizers. The International Agency for Research on Cancer (IARC) classifies formaldehyde as a human carcinogen.[48] Sunscreen additives benzophenone and its derivative oxybenzone are hormone disruptors linked to cancer, reproductive and developmental toxicity, allergies and ecotoxicity. Talc, an ingredient in baby powders, can be contaminated with asbestos. Talc is a respiratory irritant and talc containing asbestos is associated with cancer and organ system toxicity. Fragrances added to personal care products may be composed of dozens, if not hundreds of individual chemicals, some of which are toxic (such as acetaldehyde, benzophenone, BHA, BHT, methylene chloride, DEP, parabens and more) that are not required to be labeled. [49]

4. Flame Retardants

Appendix 1 summarizes health risks and exposures to flame retardants of concern in consumer products. Flame retardants (FRs) migrate out of products into dust and into the human body. Because children play on the floor and put their fingers in their mouths, they ingest higher levels of these chemicals than adults.[50] [51] Children can also be exposed to flame retardants through breathing and through the skin.

The Centers for Disease Control and Prevention (CDC) has identified flame retardants in the bodies of more than 90% of Americans. Toddlers have up to five times the levels of flame retardants in their bodies compared with their parents.[52] [53] A higher number of infant products in the home has been correlated with higher FR exposure. Infants with more than 17 products in the home had almost seven times the levels of metabolites of TDCPP compared with those in homes with under 13 products.[54]

While certain brominated FRs have mostly been phased out for use in foam products, replacement chemicals, some of which still contain bromine or chlorine, are now found in the home and in the human body. Levels of organophosphate replacement chemicals in urine samples (TPP, TDCPP) increased significantly over the past ten years.[55] Firemaster 550 chemical constituents (TBB, TBPH) were detected in 100% of household dust samples and 95-100% of hand wipe samples from mother-child study pairs.[56] Replacement FRs (TDCPP, TCEP, TBB) have been detected in numerous house dust studies[57] and in child care environments.[58]

Since halogenated flame retardants (those with chlorine or bromine) have become global pollutants and build up in the food chain, people can be exposed from eating fish, meat or dairy products.[59] Ten percent of infants in the U.S. may be exposed to brominated FRs in breast milk that exceed the reference dose (safety threshold established by U.S. EPA.)[60] After California banned certain brominated FRs, levels in breast milk declined by 39% in first time mothers.[61]

Exposure to toxic flame-retardant ingredients is associated with numerous adverse health effects. Components of Firemaster 550 (TBB, TBPH) were linked to endocrine disruption and obesity in rats[62] and adverse effects on brain development and reproduction. TCEP, TDCPP and chlorinated paraffins have been identified as carcinogens.[63] [64] [65] Halogenated FRs TBBPA, TBPH, TBB, TCPP and V6, containing chlorine or bromine, have potential to release carcinogenic dioxins and dioxin-like compounds.

5. Heavy metals

Heavy metals, including lead, cadmium, antimony and arsenic are added at low levels and show up as contaminants in many children's products. Lead and cadmium are toxic to the brain and arsenic exposure is associated with higher risk for cancer, neurotoxicity, cardiovascular disease and other adverse effects. Antimony is frequently in children's products both as a contaminant and for functions such as coloration, hardening, strength, protective coating and as a flame retardant. Exposure to antimony is associated with eye and lung irritation and adverse effects on heart, lung and the digestive system. The International Agency for Research on Cancer (IARC) also considers antimony a possible human carcinogen.[66]

6. Per- and Polyfluoroalkyl substances (PFASs)

PFASs are a class of chemicals used to greaseproof or waterproof consumer products including non-stick cookware, outdoor apparel and food packaging, such as pizza boxes, fast food wrappers and popcorn bags. They are also used in electronics, firefighting foam, and chemical manufacturing. The most well-known PFASs are PFOA and PFOS, but both have been phased out of production in the United States in recent years,[1] although they are still used and manufactured internationally. These highly fluorinated chemicals are extremely persistent in the environment and in the human body. Studies demonstrate that PFOA and PFOS are linked to multiple health effects such as liver and metabolic toxicity, reproductive and developmental toxicity, tumor induction, immunotoxicity, endocrine disruption and neurotoxicity.[67] Data on human health effects of other PFASs is scarce, but animal studies suggest they may have similar toxic effects.

Long chained PFASs (PFOS and PFOA) are linked to increased risk for thyroid disease in adults[68] and decreased immune response to vaccines in children.[69] In addition higher levels of PFOA in blood is associated with obesity in children.[70] PFOA exposure is associated with kidney and testicular cancer in animals and has also been linked to higher incidence of these cancers among adults living near a chemical plant.[71]

While most products in the United States no longer contain PFOA or PFOS ("long-chained" PFASs), these chemicals have been replaced with "short-chained" PFASs. These replacement chemicals have been touted as being safer than PFOA or PFOS but new data suggest that short-chained PFASs may have some of the same health effects as the chemicals they are replacing.

The ability of PFASs to repel water and grease comes from their multiple carbon-fluorine bonds. Due to the strength of the carbon-fluorine bond, PFASs are persistent in the environment. PFASs have no known degradation pathways in the environment[72] meaning that they stay in surface water,[73] groundwater,[74] wildlife[75] and people[76] and are passed down through generations from mother to child through umbilical cord blood and breastfeeding.[77] These chemicals move throughout the globe as a result of human use and end up in areas such as the arctic[78], remote wildlife areas, and the open oceans.

One commonly cited benefit of short-chain PFASs is that are less bioaccumulative than long-chained PFASs. However, while they may not bioaccumulate as much in blood, one study has detected short-chain PFASs in human organs suggesting that we do not fully understand if humans are able to eliminate these chemicals.[79] Additionally, studies have shown that short-chained PFASs are persistent (i.e. they do

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[1] According to the EPA, "The manufacture and import of PFOA has been phased out in the United States as part of the PFOA Stewardship Program." The EPA notes there may be PFOA in some imported articles. www.epa.gov/assessing-and-managing-chemicals-under-tsca/fact-sheet-20102015-pfoa-stewardship-program

not breakdown) in the environment, another similarity to the long-chained PFAS.[80] A recent study also suggests that exposure to short-chained PFASs can lead to endocrine disruption in pregnant women and their fetuses.[81] Finally, recent studies have shown that there is disproportionate transfer of short-chain PFASs through umbilical cord blood to newborns.[82]

There is a lack of health risk information on most of the more than 3,000 PFASs intentionally used in products. While studies of short-chained PFASs are emerging, the evidence thus far is not promising. For this reason, leading scientists are calling on "the international community to cooperate in limiting the production and use of PFASs and in developing safer non-fluorinated alternatives."[83]

7. Phthalates

Phthalates are plasticizers added to a variety of consumer products and used as fragrance binders in personal care products. Ninety percent of phthalates are added to vinyl (PVC) plastic to make it softer and more flexible in products such as shower curtains, purses, pet toys, food packaging, backpacks, raincoats, clothing embellishments and more. One study found that phthalates were the most abundant chemicals in indoor air and house dust.[84] Young children are exposed to phthalates through inhalation, ingestion and even through dermal absorption. A Danish study of 3-6 year olds identified dermal absorption as the primary exposure route for DEP, DnBP and DIBP in the indoor environment.[85]

While biomonitoring studies find that urinary levels of some phthalate metabolites (metabolites of DEP, DnBP, BBzP, DEHP) decreased between 17 and 42 percent, others (metabolites of DiBP, DnOP, DiDP, DiNP) increased between 15 and 206 percent between 2001-2002 and 2009-2010.[86] These findings may indicate that regulation of certain phthalates has decreased use and exposure, but other harmful phthalates are being used as substitutes. Phthalate exposure remains widespread and an estimated 1% of women of childbearing age with high-end exposures to phthalates may be at risk for adverse effects on their babies, if they become pregnant.[87]

Phthalates in personal care products could be an important source of exposure for infants who have immature metabolic and immune systems. Use of lotions, powder and shampoo with infants was associated with increased levels of phthalates in urine and was strongest in young infants.[88] Phthalate exposure is linked to adverse effects on the brain. One study found that reductions in child IQ were correlated with higher maternal exposure levels of phthalates in urine during pregnancy.[89]

Di(2-ethylhexyl) phthalate (DEHP) is of particular concern, as a hormone disruptor and a possible human carcinogen, affecting the liver.[90] [91] The CDC bio-monitoring program has identified metabolites of DEHP in nearly everyone tested. Exposure to DEHP is associated with liver and thyroid toxicity, reproductive abnormalities and adverse effects on the respiratory system, including asthma.[92] There is also emerging evidence that DEHP is an obesogen. Higher urinary phthalate metabolite concentrations in adult males were associated with increased waist circumference and insulin resistance.[93] Children with higher DEHP levels were more likely to have higher body mass index.[94]

In addition to DEHP, there is evidence of harm to health from numerous phthalates. DBP, DBP, DEP, DMP and DiBP have been variously linked to hormone disruption, infertility and other reproductive problems, tumor formation, breast cancer and early breast development.[95] The Chronic Hazard Advisory Panel (CHAP) of the Consumer Product Safety Commission recommended a ban on the following phthalates in children's products because of health concerns DEHP, DBP, DIBP, BBP, DINP, DCHP, DPENP, DIOP and DHEXP. They noted that "DINP had the maximum potential for exposure to infants, toddlers, and older children" and exposure to DINP was from food, from mouthing teethers and toys, and from dermal contact with child care articles and home furnishings. The CHAP recommends that U.S. agencies "conduct the necessary risk assessments with a view to supporting risk management steps" regarding exposures from food and other products for numerous phthalates.[96]

8. Solvents

Solvents are substances used in industrial applications and by consumers to dissolve other substances or chemicals. Common exposure to solvents (toluene, ethyl alcohol, turpentine, acetone, kerosene, benzene, naphthas, lacquer thinners, mineral spirits, methyl chloroform) occurs through use of: paint; paint strippers/ thinners; varnishes; dry cleaning chemicals; cleaners/degreasers; nail polish and removers; spot removers; art materials; adhesives; glues; or automotive products.

Studies of long-term and high exposures to organic (carbon-based) solvents, as in the workplace, present a high health hazard, including severe acute symptoms, such as blindness, irregular heartbeat, and damage to organs and nervous system. While household exposure levels are significantly lower than workplace exposures, it's important to note that many solvents are: 1) carcinogens or reasonably anticipated to be human carcinogens (benzene, carbon tetrachloride, chloroform, 1,4-dioxane, perchloroethylene, styrene, trichloroethylene);[97] 2) reproductive toxicants (2-ethoxyethanol, 2-methoxyethanol, methyl chloride); and/or 3) recognized neurotoxins (n-hexane, tetrachloroethylene (TCE) and toluene).[98]

Numerous solvents of concern are present at low levels as contaminants and intentionally added to children's products, including 4-nonylphenol, acetaldehyde, dibutyl phthalate, ethylbenzene, ethylene glycol, methyl ethyl ketone, methylene chloride, and toluene. They are found in product components such as surface coatings, textiles, inks/dyes, synthetic polymers, and bio-based materials.[99]

Section 2: Chemicals of Concern in Baby and Toddler Products

Many chemicals with potential to harm the health of children are still found in consumer products designed for children under age 3. Some chemicals serve a specific function within the product such as preservative, stabilizer, surface coating, colorant, catalyst, plastics component, flame retardant, protective coating, solvent, plasticizer, surfactant, adhesive, or other function. Other chemicals are not intentionally added and serve no function, but are present as contaminants within the product. While many chemicals of concern have been phased out of baby products, such as most brominated flame retardants, BPA in baby bottles and sippy cups and formaldehyde-releasing chemicals in children's personal care products, many chemicals of concern remain.

A. Washington State Children's Safe Products Act Reporting Data (as of July 2017)

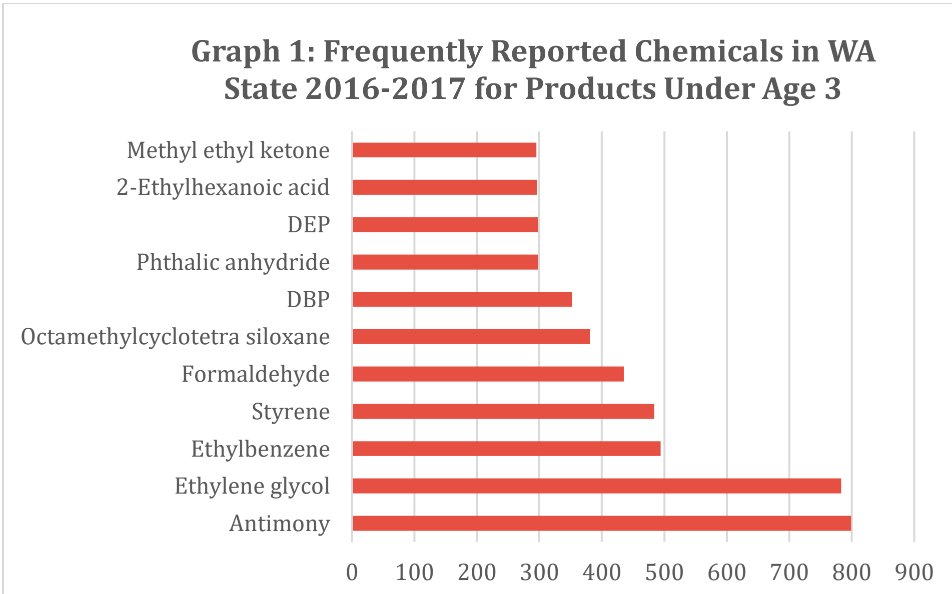
The best representation of chemicals in durable products designed for children is available through Washington State's children's product data reporting. Manufacturers of children's products sold in the state of Washington are required to report annually to the Washington Department of Ecology the presence of any of 66 chemicals of high concern to children in their products. They are required to report on the function of intentionally added chemicals and whether the chemical is a contaminant in specific product categories for a range of chemical concentrations, as required by the Children's Safe Products Act. Chemicals in electronic products, most personal care products and food packaging are not required to be reported under this law. www.ecy.wa.gov/programs/hwtr/RTT/cspa/index.html

Below is a summary of chemicals reported at levels of 100 parts per million or greater (excluding cobalt and molybdenum) in the most recent reporting years, 2016 and 2017, retrieved from the WA State database as of September 21, 2017. Within these parameters, manufacturers reported the presence of forty-four unique chemicals in products for children age 3 and under. Thirty-five chemicals were reported as contaminants, 34 as serving a function in the product and 27 as both.

The chemicals most frequently reported include (Graph 1):

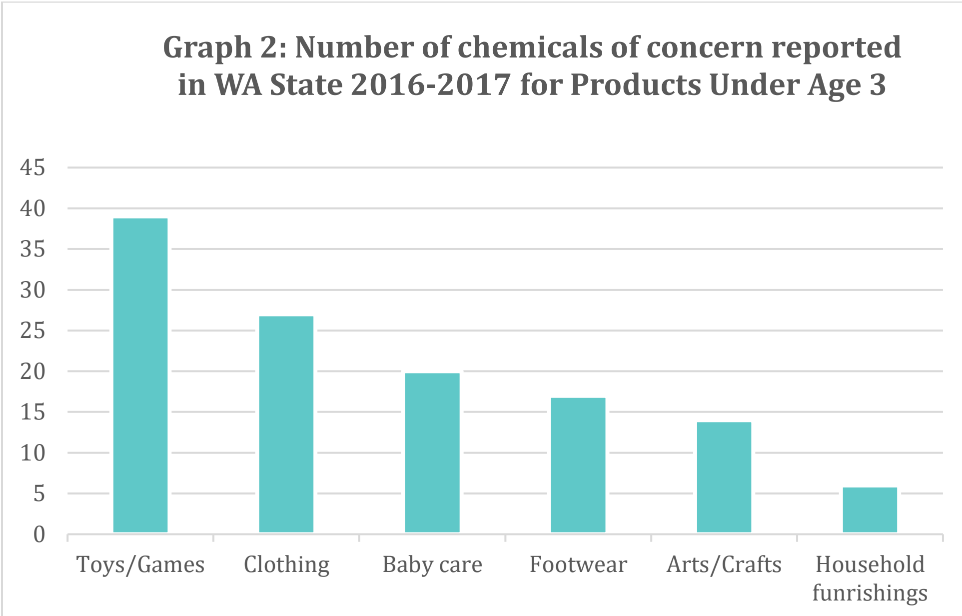
- Antimony and antimony compounds (799 products) were reported in footwear, baby care, clothing, toys/games, accessories and more, as both a contaminant and to serve a variety of functions including coloration, catalyst, flame retardant, protective coating, hardening and strength, at levels up to 10,000 ppm or 1% of the product.
- Ethylene glycol (783 products) was reported in clothing, baby care, footwear, toys/games and more as both a contaminant and to serve a variety of functions including solvent, catalyst, accelerator and manufacturer additive at levels up to 10,000 ppm or 1% of the product.
- Ethylbenzene (495 products) was reported in clothing, baby care, toys/games, stationery, arts/crafts, accessories and more, as both a contaminant and to serve a variety of functions including coloration, solvent, adhesive, protective coating, plasticizer, strength, plastic component, and textile additive at levels up to 10,000 ppm or 1% of the product.

- Styrene (484 products) was reported in clothing, baby care, footwear, toys/games, clothing and more as both a contaminant and to serve a variety of functions including components of plastic, adhesive, strength, plasticizer and accelerator at levels up to 10,000 ppm or 1% of the product.



Chemicals in Product Categories - Graph 2:

- Toys and games contained 39 chemicals of concern, including BPA, cadmium, antimony, eight phthalates, ethylene glycol, formaldehyde, methyl paraben, phenol, styrene, toluene, vinyl chloride and more.
- Twenty-seven chemicals were reported in clothing, including antimony, nonylphenols, eight phthalates, methyl ethyl ketone, phthalic anhydride and styrene.
- Baby Care Products contained 20 chemicals of concern, including antimony, arsenic, three phthalates, ethylene glycol, formaldehyde, phenol, styrene, toluene, vinyl chloride and more.
- Seventeen chemicals were reported in footwear, including acetaldehyde, acrylonitrile, antimony, nonylphenols, three phthalates, ethylene glycol, formaldehyde, methyl ethyl ketone, phenol, phthalic anhydride, styrene and toluene.
- Fourteen chemicals were reported in arts and crafts materials, six in household textiles and three more in other product categories such as personal care, accessories, camping, kitchen merchandise and stationery.



Chemicals reported at the highest concentrations in individual products include:

- 2-ethylhexanoic acid was reported in toys/games for use in synthetic polymers as a stabilizer and as a contaminant at over 10,000 ppm (1% of the product) for a Home Depot powered soft doll toy.
- 4-nonylphenol 4-NP and its isomer mixtures was reported in footwear, baby care, clothing and toys/games as both a contaminant and for use in surface coatings. Two Crayola art supply products had levels over 10,000 ppm, or over 1% of the product.
- Antimony and antimony compounds were reported as a contaminant at concentrations up to 10,000 ppm (1% of the product) in a Home Depot powered soft doll toy and the same concentration as a flame retardant in a developmental water toy made by Intex Recreation.
- Diethyl phthalate (DEP) was reported as a contaminant and plasticizer or strengthener in 59 footwear, sleepwear and clothing products made by Gap, Gymboree, ABG Accessories, Under Armour and Home Depot at levels over 10,000 ppm, or more than 1% of the product.
- Methylene chloride was reported for use as a solvent in synthetic polymers at a concentration up to 10,000 ppm (1% of the product) in a non-powered infant stimulation toy made by MGA Entertainment and Little Tykes.
- Vinyl chloride was reported by Excelligence Learning Corporation and the Step2 Company in baby cots/beds, non-powered infant stimulation toys and in non-powered ride on toys as plastic components, plasticizers or for coloration at levels over 10,000 ppm, or more than 1% of the product.

B. Chemicals of Concern in Personal Care Products and Disposable Diapers

As described in section 2, personal care products designed for babies and young children include a variety of potentially harmful chemicals. In addition, daily use of baby wipes for diapering and clean-up provide a potentially high chemical exposure route for babies. Baby wipes often contain some of the same chemicals of concern noted above, such as formaldehyde-releasing preservatives, fragrance, parabens, phthalates, chlorine, allergenic phenoxethanol, and polysorbate-20 and PEG chemicals, which can release 1,4-dioxane. In addition, traces of allergenic hydroquinone may be present in baby wipes, as this chemical is used to produce tocopherol acetate, a common ingredient. Several baby wipe brands now offer biodegradable wipes with safer plant-based ingredients and disclose all ingredients.

Some chemicals of potential concern in disposable diapers are fragrance, dyes, chlorine, latex, tributyl-tin and volatile organic compounds such as ethylbenzene, toluene and others. One study found that a mixture of chemicals in diapers was toxic to the respiratory tract.[100] Several disposable diaper brands are safer for the environment and human health as they use plant based and biodegradable ingredients and disclose all ingredients.

C. Chemicals of Concern in Food Processing and Packaging for Baby and Toddler Foods

Many food items for infants and toddlers are packaged in plastic. Plastic is known to leach chemicals, including BPA, phthalates and other endocrine-active chemicals. Even plastics that don't contain BPA or have no added phthalates have been found to leach endocrine-active compounds.[101] **BPA** is frequently used in epoxy linings of metal food cans.[102] Some food packaging also includes perfluorinated chemicals or **PFASs**, which are used in grease-resistant coatings.

The primary route of exposure to the **phthalates** DEHP and DINP is through diet, both through food packaging and direct food contamination during processing. Phthalates DEHP and DnBP were detected in infant formula.[103] Biomonitoring studies that measured urinary levels of phthalates before a fasting period[104] and before a dietary intervention with a packaging-free diet,[105] found significant reductions in urinary phthalates after the fasting/intervention periods. While the American Plastics Council claims that phthalates are not used in plastic bottles or food packaging, these studies illustrate that phthalates are getting into foods or food packaging in some manner. Potential sources could be food collection, processing or other food preparation prior to going to market.[106]

Product testing in 2017 uncovered further evidence of phthalates in food processing, with 29 of 30 cheese and packaged macaroni and cheese products tested found to contain one or more phthalates. Phthalate levels were four times higher in cheese powder than in natural cheese products.[107] This is concerning, since packaged macaroni and cheese is a favorite food of children and frequent consumption could add to their cumulative exposure to phthalates.

High levels of **arsenic** have been detected in infant rice cereals. Rice uptakes up to ten times more arsenic than other grains, so 100% rice cereals have higher levels. It's recommended that infants consume cereal made of oats, quinoa or mixed grains, where rice is the third ingredient or lower.[108]

D. Chemicals of Concern in Infant Clothing and Teethers

As noted in the summary of Washington State reporting in Section 2. A. above, 13 chemicals were reported in clothing, including antimony, nonylphenols, eight phthalates, methyl ethyl ketone, phthalic anhydride and styrene. In addition, a study that tested 77 textiles and infant clothing pieces detected bisphenols, including BPA, BPS, benzophenones, bisphenol A diglycidyl ethers (BADGEs), and novolac glycidyl ethers (NOGEs). BPA was found in 82% of items tested, with socks containing the highest concentration.[109] Testing of infant teethers found that parabens, bisphenols, benzophenone-type UV filters, triclosan and triclocarban migrated from the teethers, resulting in a daily intake of hormone disrupting chemicals by infants using them. [110]

E. Materials of Concern – Polystyrene and Polyvinyl Chloride

Styrene is a high production volume chemical used in a variety of applications, such as insulation, auto parts, fiberglass, carpet backing and packaging. Young children would most likely be exposed to styrene through polystyrene drinking cups and other food containers and as a component of plastic resin for making toys, clothing and other articles. The presence of styrene in toys, footwear, baby care items, furnishings, clothing and arts/crafts was reported to Washington State as a contaminant and to provide functions such as adhesive, plasticizer or strengthener in surface coatings, synthetic polymers and other components.[111]

Vinyl chloride (used to manufacture polyvinyl chloride, PVC) is one of the highest production volume chemicals in the world and is used to make PVC infant and children's toys, pipes, wire coatings, vehicle upholstery, wall coverings, flooring and various household goods. PVC is considered to be toxic throughout its lifecycle. The production of PVC contaminates workers and communities through the releases of pollutants such as vinyl chloride, ethylene dichloride, mercury, dioxins and furans, and PCBs, linked to cancer, birth defects and other serious health effects. In addition, PVC products expose consumers to harmful chemical additives such as phthalates, lead, cadmium and organotins. The use of vinyl chloride in baby cots and toys was reported to Washington State as a component of plastic resin and for coloration in surface coatings, synthetic polymers and inks/dyes.[112] The eventual disposal of PVC is a significant source of dioxins and furans, considered to be among the most toxic chemicals on the planet.

Section 3: Current Product Chemical Regulations

A. Regulation of Flame Retardants in Children's Products

Table 2 summarizes listing and regulation of flame retardants (FRs) sometimes found in children's products. Penta-BDE, octa-BDE, though commonly used in foam products in the past, were banned in several states and phased out by industry. Several FRs still in use are listed as chemicals of concern by government entities and ten are banned in children's products in one or more states. In 2017 the state of Rhode Island passed a ban on organohalogen FRs (those with chlorine or bromine) in furniture and children's products and Maine passed a ban on all FRs in furniture. The Consumer Product Safety Commission has recommended that consumers be warned about potential health risks from exposure to organohalogen FRs in furniture, children's products, mattresses and electronics. The City of San Francisco has enacted a ban on FRs over 1000 ppm in upholstered furniture and juvenile products effective January 1, 2019 and requires labeling of products as FR-free.

TABLE 2: Flame Retardant Listing and Regulation

Chemical	Chemicals of Concern list [1]	Banned in children's or other consumer products	EU REACH [2]	EPA work plan [3]	Stockholm Convention POPs [4]
Deca-BDE	CA, WA, ME, OR, VT, MN, MA TURA*	ME, MD, VT, WA, MN, RI, City SF	candidate	■	■
HBCD	CA, WA, OR, VT, ME, MN, MA TURA*	MN, WA, RI, City SF ME furniture	candidate	■	■
TBBPA	CA, WA, VT, OR, ME, MA TURA*	WA (additive form), RI, City SF, ME furniture		■	
TCEP	CA, WA, ME, VT, OR	MD, VT, WA, MN, NY, RI, City SF, ME furniture	candidate	■	
TDCPP	CA, WA	MD, VT, WA, MN, NY, RI, City SF, ME furniture		■	
TBPH	CA, WA	RI, City SF, ME furniture		■	
TBB	CA, WA	RI, City SF, ME furniture		■	
TCPP	CA, WA	RI, City SF, ME furniture		■	
Chlorinated paraffins	MA TURA*, WA	RI	candidate	■	■
TPP	WA	City SF, ME furniture			
IPTPP	WA	City SF, ME furniture			
V6	WA	City SF, ME furniture			
*Massachusetts Toxics Use Reduction Act					

Table notes:

1. State agency lists of chemicals of concern required by state statutes, for either listing, labeling or reporting purposes.
2. REACH is the chemical regulatory system in the European Union. Candidate chemicals have been identified as substances of very high concern, which could be subject to authorization for use. Authorization may be granted to companies to utilize chemicals, subject to conditions or restrictions. echa.europa.eu/regulations/reach/understanding-reach
3. The U.S. Environmental Protection Agency TSCA Work Plan includes chemicals to be prioritized for assessment based on their hazardous characteristics and potential human exposure. www.epa.gov/assessing-and-managing-chemicals-under-tsca/tsca-work-plan-chemicals

4. The Stockholm Convention is a global treaty designed to eliminate or restrict the production of persistent organic pollutants (POPs). www.pops.int

B. Regulation of Lead and Phthalates in Children's Products

Table 3 summarizes the listing and regulation of lead and certain phthalates by U.S. state and federal governments and the European Union. Lead and phthalates in children's toys and child care articles may not exceed .1% or 1000 PPM under the U.S. Consumer Product Safety Improvement Act (CPSIA).[113] Child care articles are defined as articles "designed or intended by the manufacturer to facilitate sleep or the feeding of children age 3 and younger, or to help children age 3 and younger with sucking or teething."[114] The CSPIA also includes compliance testing, certification and tracking requirements.

The CPSC now bans eight phthalates in these products, per the recommendations of the Chronic Hazard Advisory Panel (CHAP) which was charged with reviewing the interim ban on certain phthalates under CPSIA. The CHAP also recommended that U.S. agencies "conduct the necessary risk assessments with a view to supporting risk management steps" regarding exposures from food and other products for numerous phthalates.[115]

TABLE 3: Lead and Phthalate Listing and Regulation

Chemical	Chemicals of Concern list	CPSIA Ban in toys, child care articles	State bans (many preempted by CPSIA)	EU REACH	EPA work plan
Lead	CA, MN, MA TURA*	■	CA, IL, MD, VT, WA, MI CT, MN- jewelry DE- toys		■
DEHP	CA, WA, ME, MN, OR, VT, MA TURA*	■	CA, VT, WA***	Author-ization	■
BBP	CA, WA, ME, MN, OR, VT, MA TURA*	■	CA, VT, WA***	Author-ization	■
DBP	CA, WA, ME, MN, OR, VT	■	CA, VT, WA***	Author-ization	■
DINP	WA, OR, VT	■	CA, VT, WA***		■
DIDP	WA, OR, VT		CA, VT, WA***		■
DnOP	WA, OR, VT, MA TURA*		CA, VT, WA***		■
DEP	ME, WA, OR, VT, MA TURA*				
DnHP or DNEXP	CA, ME, WA, OR, VT	■			
DIBP	WA	■		Author-ization	■
DCHP	WA	■			
DPENP or DPP	WA	■		Candi-date	

*Massachusetts Toxics Use Reduction Act **Covers toys and child care articles placed in the mouth.
*** Regulation of phthalates in children's clothing not preempted.

C. Regulation of BPA in Children's Products

Table 4 summarizes various government regulations on use of BPA in consumer products. Thirteen U.S. states, four counties in New York, the city of Chicago and the FDA have banned BPA in baby bottles and sippy cups and seven states ban BPA in other children's food packaging, such as formula cans, baby food jars and toddler food. None of the state bans include canned food, with the exception of canned infant formula. However, under California Prop 65, retailers are required to post information at cash registers to refer consumers to an on-line database for information on cans that contain BPA, instead of requiring an on-label warning. The state of Connecticut also bans BPA in thermal receipt paper. In addition, 15 countries restrict BPA in children's food packaging, including Canada, France, Denmark and others.

TABLE 4: BPA Listing and Regulation

US State or Country	Chemicals of Concern list	Banned in baby bottles, sippy cups	Banned in other children's food packaging	Banned in thermal receipts
CA	■	■		
CT		■	■	■
DE		■		
IL		■	■	
MA		■		
MD		■		
ME	■	■	■	
MN	■	■	■	
NV		■	■	
NY		■		
OR	■			
VT	■	■	■	
WA	■	■	■	
WI		■		
U. S. (EPA)	■			
U. S. (FDA)		■		
Argentina		■		
Belgium		■	■	
Brazil		■		
Canada		■		
China		■	■	
Costa Rica		■	■	
Czech Republic		■		
Denmark		■	■	
Ecuador		■		
France		■	■	
Malaysia		■		
South Africa		■		
Sweden			■	
Turkey		■		
United Arab Emirates		■		

D. Regulation of Anti-Microbials and Formaldehyde Donors in Consumer Products

The state of Minnesota prohibits chemicals exceeding a concentration of 500 ppm in personal care products designed for children under age 8 that release formaldehyde. Minnesota also prohibits the use of triclosan in consumer hand and body cleaning products. The FDA bans triclosan, triclocarban and 17 other anti-microbial active ingredients in over-the-counter consumer personal cleansing products effective September 2017.[116]

Section 4: Priority Hazardous Chemicals for Reduction and Elimination

Getting Ready for Baby recommends the following hazardous chemicals for priority reduction and elimination in baby and children's products and packaging, including private label and brand name products. Most of these chemicals/materials are listed on the Mind the Store Hazardous 100+ List, the Campaign for Safe Cosmetics Red List of Chemicals of Concern in Cosmetics, and the Washington State Chemicals of High Concern to Children reporting list, which includes chemicals that have been detected in children's products. Chemical Abstracts Numbers are indicated.[2]

1. **Anti-microbials Triclosan (3380-34-5), Triclocarban (101-20-2)**

2. **Ethoxylates, including but not limited to:**
    a. PEG-laurate (10108-24-4)
    b. Sodium laureth sulfate (9004-82-4)
    c. Polyethylene glycol (25322-68-3)
    d. Ceteth-5 (9004-95-9)
    e. Steareth-21 (9005-00-9)
    f. Octoxynol-9 (9002-93-1)
    g. PEG-8 stearate (70802-40-3)

3. **Flame retardants, including but not limited to:**
    a. Chlorinated paraffins (85535-84-8, 85535-84-9)
    b. Decabromodiphenyl ethane (84852-53-9)
    c. Decabromodiphenyl ether (1163-19-5)
    d. EHDPP / Ethylhexyl diphenyl phosphate (1241-94-7)
    e. Firemaster 550 components: TBPH / bis(2-ethylhexyl) 3,4,5,6-tetrabromophthalate (26040-51-7), TBB / 2-ethylhexyl-2,3,4,5-tetrabromobenzoate (183658-27-7)
    f. HBCD / Hexabromocyclododecane (25637-99-4)
    g. IPTPP (68937-41-7)
    h. Octabromodiphenyl ether (32536-52-0)
    i. Pentabromodiphneyl ether (32534-81-9)
    j. TBBPA / tetrabromobisphenol A (79-94-7)

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[2] More information about the presence of each of these chemicals on international chemical hazard lists can be accessed via the Pharos publicly available software tool: www.pharosproject.net The Pharos Chemical and Material Library (CML) is an online catalog of over 46,000 chemicals, polymers, metals, and other substances that is continuously updated to provide accurate health hazard data.

k. TCEP / Tris (2-chlorethyl) phosphate (115-96-8)
l. TCP / Tricresyl phosphate (1330-78-5)
m. TCPP / tris(1-chloro-2-propyl)phosphate (13674-84-5)
n. TDBPP / Tris (2,3-dibromopropyl) phosphate (126-72-7)
o. TDCPP / Tris (1,3-dichloro-2-propyl) phosphate (13674-87-8)
p. TNBP / Tri-n-butyl phosphate (126-73-8)
q. TPP / Triphenyl phosphate (115-86-6)
r. V6 / phosphoric acid, P,P'-[2,2-bis(chloromethyl)-1'3-propanediyl] P,P,P',P'- tetrakis(2-chloroethyl) ester (38051-10-4)

4. Formaldehyde (50-00-0) and formaldehyde donors, including but not limited to:

a. DMDM hydantoin (6440-58-0)
b. Quaternium 15 (4080-31-3)
c. 2-bromo-2nitropropane-1,3-diol (52-51-7)
d. Imidazolidinyl urea (39236-46-9)
e. Diazolidinyl urea (78491-02-8)
f. Benzyl hemiformal (14548-60-8)
g. Sodium hydroxymethylglycinate (70161-44-3)
h. Tris(hydroxymethyl)nitromethane (126-11-4)

5. Heavy metals:

a. Antimony and compounds (7440-36-0)
b. Arsenic and compounds (7440-38-2)
c. Beryllium and compounds (7440-41-7)
d. Cadmium and compounds (7440-43-9)
e. Chromium and compounds (7440-47-3)
f. Lead and lead compounds (7439-92-1)
g. Mercury and compounds (7439-97-6)
h. Nickel and compounds (7440-02-0)

6. Organotins, including but not limited to:

a. Dibutyltin dichloride (683-18-1)
b. Tributyltin oxide (56-35-9)
c. Triphenyltin hydroxide (76-87-9)

7. Ortho-phthalates, including but not limited to:

a. Phthalic anhydride (85-44-9)
b. BBP / Benzyl butyl phthalate (85-68-7)
c. DEHP / di-(2-ethylhexyl) phthalate (117-81-7)

d. DBP / dibutyl phthalate (84-74-2)
e. DEP / diethyl phthalate (84-66-2)
f. DIBP / diisobutyl phthalate (84-69-5)
g. DIDP / diisodecyl phthalate (26761-40-0)
h. DINP / diisononyl phthalate (28553-12-0)
i. DnHP or DHEXP / di-n-hexyl phthalate (84-75-3)
j. DnOP / di-n-octyl phthalate (117-84-0)
k. DCHP/ dicyclohexyl phthalate (84-61-7)
l. DIOP / diisooctyl phthalate (27554-26-3)
m. DMEP / Di(2-methoxyethyl) phthalate (117-82-8)
n. DPP / Di-n-pentyl phthalate (131-18-0)

8. Parabens, including but not limited to:

a. Butyl paraben (94-26-8)
b. Ethyl paraben (120-47-8)
c. Methyl paraben (99-76-3)
d. Propyl paraben (94-13-3)

9. Per and polyfluoroalkyl substances (PFASs), including but not limited to:

a. PFOS / perfluorosulfonic acid and salts (1763-23-1)
b. PFOA / perfluorocarboxylic acid and salts (335-67-1)
c. PFHxS / perfluorohexane sulfonic acid and salts (355-46-4)
d. PFHxA / perflurohexanoic acid and salts (307-24-4)
e. PFOSA / perfluorosulfonamide (754-91-6)
f. Other highly fluorinated chemicals

10. Phenols:

a. 4-tert-Octylphenol; 1,1,3,3-Tretramethyl-4-butylphenol (140-66-9)
b. Phenol (108-95-2)
c. Phenol, 4-octyl- (1806-26-4)
d. Bisphenols, including but not limited to Bisphenol A (80-05-7), Bisphenol S (80-09-1), Bisphenol-F (620-92-8)
e. Hydroquinone (123-31-9)
f. Nonylphenol and Nonylphenol ethoxylates (84852-15-3, 25154-52-3, 9016-45-9, 104-40-5,)

11. Solvents:

a. 1,1, 2, 2-Tetrachloroethane (79-34-5)
b. 1, 4-Dioxane (123-91-1)
c. 2-Methoxyethanol (109-86-4)
d. Acetaldehyde (75-07-0)

e. Benzene (71-43-2)
f. Carbon disulfide (75-15-0)
g. C.I. Solvent Yellow 14 (842-07-9)
h. Ethylbenzene (100-41-4)
i. Ethylene glycol (107-21-1)
j. Ethylene glycol monoethyl ether (110-80-5)
k. Hexachlorobutadiene (87-68-3)
l. Methylene chloride (75-09-2)
m. Methyl ethyl ketone (78-93-3)
n. Perchloroethylene (127-18-4)
o. P-Hydroxybenzoic acid (99-96-2)
p. Styrene (100-42-5)
q. Toluene (108-88-3)

12. Other organic compounds and chemicals of concern:

a. 2-Aminotoluene (95-53-4)
b. 2, 4-Diaminotoluene (95-80-7)
c. 2-Ethylhexanoic acid (149-57-5)
d. 2-Ethyl-hexyl-4-methoxycinnamate (5466-77-3)
e. 3,3'-Dimethylbenzidine and dyes metabolized to 3,3'-Dimethylbenzidine (119-93-7)
f. Acrylonitrile (107-13-1)
g. Aniline (62-53-3)
h. Benzene, pentachloro (608-93-5)
i. Benzophenone-2 (Bp-2); 2,2',4,4'-Terahydroxybenzophenone (131-55-5)
j. Butylated hydroxyanisole; BHA (25013-16-5)
k. Estragole (140-67-0)
l. Hexachlorobenzene (118-74-1)
m. N-nitrosodimethylamine (62-75-9)
n. N-nitrosodiphenylamine (86-30-6)
o. Octamethylcyclotetrasiloxane (556-67-2)
p. Oxybenzone (131-57-7)
q. Para-Chloroaniline (106-47-8)
r. Phthalic anhydride (85-44-9)
s. Retinyl palmitate (79-81-2)
t. Vinyl Chloride or PVC (75-01-4)

Ultimately retailers should create a broader list of priority substances for avoidance in products by considering additional chemicals that are on the Hazardous Hundred Chemicals List, Campaign for Safe Cosmetics Red List of Chemicals of Concern in Cosmetics and other authoritative lists (see Section 6.)

The Priority Chemicals of Concern list should include chemicals that meet the following criteria:

1) persistent, bioaccumulative and toxic (PBT);
2) very persistent and very bioaccumulative (vPvB);
3) very persistent and toxic (vPT);
4) very bioaccumulative and toxic (vBT);
5) carcinogenic;
6) mutagenic;
7) reproductive or developmental toxicant;
8) endocrine disruptor;
9) neurotoxicant; or
10) asthmagen.

"Toxic" (T) includes both human toxicity and ecotoxicity.

Section 5: Summary Recommendations for a Comprehensive Chemicals Policy

1. Adopt a Chemicals Management Program/Policy for managing chemicals in products and supply chains with clear and quantifiable goals and timelines for implementation, with the following components:[3]

- **Establish Management Responsibilities and Incentives** for the chemicals management program across the entire organization.
- **Require suppliers/manufacturers to report the use of chemicals.**
    a. Develop a list of High Priority Chemicals of Concern to prioritize for initial action.
    b. Develop a list of Priority Product Categories to initially address. We recommend it include products that would create the highest exposure for young children.
    c. Develop a broader Restricted Substances list of utilizing authoritative government lists to signal the bigger picture to suppliers.
    d. Require manufacturers of Priority Products to report those that contain High Priority Chemicals of Concern.
- **Ensure supply chain accountability** by training suppliers, auditing compliance, requiring supplier third party testing of priority products and chemicals.
- **Commit to transparency regarding the retailer's chemicals policy and around consumer ingredient disclosure.**
- **Avoid worst chemicals and prefer safer alternatives.**
- **Commit to continuous improvement, and track it.** We recommend the Chemical Footprint Project to provide guidance and measure progress. www.chemicalfootprint.org/value

2. Focus first on products that have highest exposure potential for young children, especially foam-containing baby care items, textiles in clothing and bedding, personal care products, mattresses, infant car seats, toys and teething devices where mouthing is likely, and food and product packaging.

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[3] For more detailed guidance on how to implement good chemicals policy, please visit The Beginner's Guide for Retailers: Managing Chemicals in Products and Supply Chains, available in October 2017 at www.cleanproduction.org.

3. Feature Safer Products in Stores and On-line. Develop a program to market and feature safer products sold at your store, including products that have credible third-party certification, fully disclose product ingredients that do not contain priority chemicals of concern.

4. Support public policy and voluntary initiatives that require full chemical ingredient transparency and prefer chemicals that are inherently less hazardous, and promote development of safer chemicals and "green chemistry" solutions.

Section 6: List of Lists of Hazardous Chemicals & Guidance for Selecting Safer Alternatives

Authoritative Lists of Chemicals of Concern to Human Health or the Environment

Here is a short list of lists of chemicals of high concern to human health or the environment for retailers to incorporate into their chemical management programs:

- *Mind the Store Hazardous 100* list saferchemicals.org/methodology/;
- *Campaign for Safe Cosmetics Red List of Chemicals of Concern in Cosmetics, http://www.safecosmetics.org/get-the-facts/chemicals-of-concern/red-list/;*
- *State of California* — "List of Chemicals Known to Cause Cancer or Reproductive Toxicity" [aka the Prop 65 list] (884 substances) — Office of Environmental Health Hazard Assessment;
- *State of California Candidate Chemicals List* – http://www.dtsc.ca.gov/SCP/CandidateChemicals.cfm;
- *State of Maine* — "Designated Priority Chemicals" (2 substances) and "List of Chemicals of High Concern" (49 substances) — Department of Environmental Protection and Center for Disease Control and Prevention;
- *State of Minnesota* — "List of Priority Chemicals" (9 substances) — Pollution Control Agency and Department of Health;
- *State of Washington* — "List of Chemicals of High Concern to Children" (66 substances) — Department of Ecology and Department of Health;
- United States Environmental Protection Agency - TSCA Work Plan Chemicals https://www.epa.gov/assessing-and-managing-chemicals-under-tsca/tsca-work-plan-chemicals;
- *European Union* — "Authorisation List" (14 substances) and "Candidate List of Substances of Very High Concern for Authorisation" (138 substances) — European Chemicals Agency; and
- *ChemSec SIN List* - chemsec.org/business-tool/sin-list/

Guidance for Retailers

Beginner's Guide for Retailers: Managing Chemicals in Products and Supply Chains, Clean Production Action, available in October 2017 at www.cleanproduction.org.

BizNGO Guide to Safer Chemicals, Clean Production Action

Guidance for Selecting Safer Alternatives

The Organization for Economic Cooperation and Development's (OECD) Substitution and Alternatives Assessment Toolbox provides a comprehensive list of methods, tools, and databases for selecting safer alternatives to toxic chemicals. These tools can be useful for private label and brand name suppliers. Below is a short list of additional alternatives assessment frameworks and chemical databases that align with The Commons Principles for Alternatives Assessment which may also be useful:

Frameworks for Alternatives Assessment

- BizNGO Chemical Alternatives Assessment Protocol
- GreenScreen™ Methodology
- University of Massachusetts Lowell's Alternatives Assessment Framework
- Selecting Safer Alternatives to Toxic Chemicals and Ensuring the Protection of the Most Vulnerable: A Discussion Draft, NRDC & CHANGE Coalition.

Databases of Chemicals of Concern / Safer Chemicals / Chemical Hazard Assessments

- CleanGredients®
- GreenScreen™ List Translator (available in automated format through Pharos)
- GreenWERCS
- Interstate Chemicals Clearinghouse
- Pharos Chemical and Material Library
- SciVera Lens™
- ToxNot
- Pure Strategies, Sustainable Chemicals Management Software

Appendix 1: Flame Retardant Chemicals – Health Effects, Exposures

Flame Retardant Chemicals – Health Effects, Exposures		
Chemical/Class	**Hazards, health effects**	**Detections**
Brominated		
TBBPA (tetrabromobisphenol A) CAS#: 79-94-7	Persistent toxic chemical: on WA's PBT list Laboratory studies indicate may disrupt hormones, particularly thyroid Causes cancer in laboratory animals	Indoor dust and air Human breast milk and adipose tissue; fish, and marine mammals
TBPH (bis(2-ethylhexyl) 3,4,5,6-tetrabromophthalate) CAS#: 26040-51-7	Designated by USEPA as persistent and bioaccumulative Developmental and thyroid effects in laboratory studies Firemaster 550 product linked to excessive weight gain and early puberty	Indoor and outdoor air; house dust; sewage sludge Human blood serum, breast milk, urine (metabolites); hand wipes; marine mammals
TBB (2-ethylhexyl-2,3,4,5-tetrabromobenzoate) CAS#: 183658-27-7	Designated by USEPA as persistent and bioaccumulative Effects on sex hormone production and activity in laboratory studies Firemaster 550 product linked to excessive weight gain and early puberty	Indoor and outdoor air, house dust; sewage sludge Human urine (metabolites), breast milk and blood serum; hand wipes; marine mammals
Deca-BDE Decabromodiphenyl ether CAS#: 1163-19-5	Persistent, bioaccumulative, toxic (listed under the Stockholm convention) Neurological and thyroid impacts in laboratory and epidemiological studies	Indoor dust and air; outdoor air, sediments, surface water Human breast milk and blood serum; fish and wildlife
HBCD Hexabromocyclododecane CAS#: 25637-99-4	Persistent, toxic on WA's PBT list Reduced fertility, effects on memory and thyroid disruption in laboratory studies	Indoor dust and air; sediments, food Human adipose tissue, blood serum and breast milk; fish and marine animals
Chemical synergists/additives		
Medium and short chain chlorinated paraffins (with PVC & with antimony in HDPE plastic) CAS#s: 85535-84-8, 85535-84-9	Designated by USEPA as persistent and bioaccumulative Aquatic toxicity at low concentrations per US EPA Designated carcinogen by California. Animal studies found liver, kidney, thyroid effects and tumors.	Indoor air and dust; human breast milk; food; sediments, surface water, wastewater; freshwater aquatic species, marine animals, birds and other wildlife

Chemical/Class	Hazards, health effects	Detected in
Chlorinated organophosphates		
TDCPP **Tris (1,3-dichloro-2-propyl) phosphate** **CAS#: 13674-87-8**	Listed as carcinogen by state of California Linked to hormone disruption and harm to the nervous system.	Indoor dust and air; human urine and breast milk; surface and drinking water; fish, birds
TCEP **Tris (2-chlorethyl) phosphate** **CAS#: 115-96-8**	Listed as carcinogen by state of California Laboratory studies indicate harm to the nervous system and fertility	Indoor air and dust; surface water
TCPP **Tris (1-chloro-2-propyl) phosphate** **CAS#: 13674-84-5**	Classified high for persistence by U.S. EPA Linked to nervous system and developmental harm, disruption of thyroid and metabolism in laboratory studies	Indoor dust and air; human urine and breast milk; surface and drinking water; fish; birds
V6 **(phosphoric acid, P,P'-[2,2-bis(chloromethyl)-1'3-propanediyl] P,P,P',P'-tetrakis(2-chloroethyl) ester** **CAS#: 38051-10-4**	An impurity in the mixture, TCEP, is classified as a carcinogen by state of CA and reproductive toxin by EU Laboratory research found effects on reproduction and organs EPA classified as high risk for effects on development and moderate risk for effects on reproduction	Indoor house dust; car dust
Phosphate-based		
TPP **Triphenyl phosphate** **CAS#: 115-86-6**	High hazard for toxicity from repeated exposures Reproductive and fetal effects in laboratory studies Evidence of endocrine disruption in human and laboratory studies Metabolic disruption in rat studies Aquatic toxicity	Indoor dust and air; human urine, breast milk, hair; drinking water.
IPTPP **Isopropylated triphenyl phosphate** **CAS#: 68937-41-7**	Firemaster 550 product with high hazard for development and reproduction and toxicity from repeated doses Neurotoxicity in animal studies EPA classified as very high for aquatic toxicity	Human urine

Appendix 2: Comparing Product Certifications

Product certification is the process of certifying that a certain product has passed performance and quality assurance tests, and meets certain qualification criteria. In the search for nontoxic children's products, there are a variety of product certifications, each of which has its own voluntary standards and definitions of what is acceptable. Certifications can provide helpful guidance for retailers who prioritize children's environmental health. But not all certifications are created equally.

Here are descriptions of three main types of certifications, which will shed some light on which certifications are the most stringent.

- **First-party** certifications are made by companies themselves. These self-certifications tend to be designed to fit a product, rather than the other way around. The Federal Trade Commission has cracked down on environmental claims from product makers, including for example actions against Pure Rest/Eco Baby's self-made "National Association of Organic Mattress Industry" seal for mattresses and Benjamin Moore's "Green Promise" seal it displayed on paint cans.
- **Second-party** certifications are made by trade associations for the relevant sector. These vary in how far beyond legal requirements they go, for example, following legal requirements for quantities allowed for various chemicals. Examples include Certipur-US and GOTS.
- **Third-party** certifications are developed and run by non-profit organizations or government bodies with no financial stake in the outcome. In general, third-party certifications are the most health protective and address the broadest range of concerns. They tend to evolve over time along with the trend toward safer products. Independent third-party certification means that an independent organization has reviewed the manufacturing process of a product and has independently determined that the final product complies.

Getting Ready for Baby preferred certification

The Getting Ready for Baby campaign recognizes the Made Safe certification as a comprehensive third party certification that addresses chemicals of concern in a robust manner.

MADE SAFE is a comprehensive human health-focused certification for nontoxic products across store aisles, from baby to personal care to household and beyond, useful for consumers, companies and retailers. MADE SAFE screens ingredients against a Toxicant Database of known harmful chemicals, which is made up of thousands of chemicals found on scientifically authoritative lists from organizations and agencies around the world. madesafe.org

Examples of third party certifications:

The AP (Approved Product) Seal identifies art materials that are safe and that are certified to contain no materials in sufficient quantities to be toxic or injurious to humans, including children, or to cause acute or chronic health problems. ACMI's toxicology team is located at Duke University's Division of Occupational and Environmental Medicine. www.acmiart.org

Asthma and Allergy Foundation of America - tests household products against proprietary standards to verify claims that products do not contain allergenic or irritating materials, including toys. www.aafa.org/page/certified-asthma-allergy-friendly.aspx

Cradle to Cradle is a multi-attribute eco-label that includes: material health, material reutilization, renewable energy and carbon management, water stewardship and social fairness. Product certification is awarded at five levels (basic to platinum). At the Silver level materials are required to "not contain carcinogenic, mutagenic, or reproductively toxic chemicals in a form that may result in plausible exposure." Cradle to Cradle acknowledges continuous improvement and innovation of products and processes towards the goal of being not just "less bad" but also "more good" for people and the planet. www.mcdonough.com/organizations/cradle-cradle-products-innovation-institute/

Safer Choice is EPA's label for safer chemical-based products. Every chemical, regardless of percentage, in a Safer Choice-labeled product is evaluated through EPA's rigorous scientific process and only the safest ingredients are allowed. The Standard incorporates safer chemical criteria for individual component class ingredients, like surfactants, solvents and chelants. To help formulate safer products and to increase transparency and understanding of safer ingredients, Safer Choice developed the Safer Chemical Ingredients List, which contains over 750 chemicals that meet Safer Choice criteria. www.epa.gov/saferchoice/learn-about-safer-choice-label

Organic certification run by the US Food and Drug Administration covers the products of farming, including all food products, not finished textile products like bedding. It certifies that certain synthetic pesticides and fertilizers were not used in farming, but does not address what kinds of chemicals were used converting raw organic material into finished products. Consumers and retailers should be suspicious of non-food items bearing this logo.

Textile products can be certified by Oeko-Tex®, which offers a range of certifications for textiles meeting different criteria. www.oeko-tex.com/en/business/certifications_and_services/mig/mig_start.xhtml

Organic cotton textiles are now certified by the Global Organic Textile Standard, which is run by four organizations: Organic Trade Association (USA), International Association of Natural Textiles (Germany), Soil Association (UK) and JOCA (Japan). www.global-standard.org/

A new **Global Organic Latex Standard** is offered by Control Union, which verifies that latex rubber comes from organically managed rubber trees, and tracks the material through to final product to ensure harmful chemicals are not used in production. certifications.controlunion.com/en/certification-programs/certification-programs/gols-global-organic-latex-standard

GreenGuard – This program, run by Underwriter's Laboratory (UL), certifies interior products and materials that have low chemical emissions, improving the indoor air quality. All certified products must meet emissions standards based on established chemical exposure criteria. greenguard.org/en/about.aspx

GreenGuard Gold (formerly and still sometimes listed as "Children and Schools") This UL standard includes health based criteria for additional chemicals and requires a total VOC emission level ten times lower than that of GreenGuard standard to ensure that products are acceptable for use in environments such as schools and healthcare facilities. greenguard.org/en/Certification Programs/CertificationPrograms_childrenSchools.aspx

Indoor Advantage Gold by SCS Global Services sets standards for emission rates of each chemical on the California Office of Environmental Health Hazard Assessment (OEHHA) Chronic Reference Exposure Levels (CRELs) list as well as for any chemical listed as a probable or known carcinogen or as a reproductive toxicant. www.scscertified.com/gbc/indooradvantage.php

The **Materials Analytical Services'** "green leaf" mark allows consumers to identify interior construction products, furniture and furnishings which are designed and manufactured to lower chemical emissions released into the indoor environment. www.mascertifiedgreen.com/about-us

Example of a Second-Party Certification:

Green Label Plus tests carpet, adhesives and cushion to help providers identify products with very low emissions of Volatile Organic Compounds (VOCs). Green Label Plus products are tested and certified by an independent laboratory. This is a trade association label - a "second party" certification.

www.carpet-rug.org/green-label-plus.html

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